



Incidence and Management of Early Complications of Laparoscopic Sleeve Gastrectomy for morbid obesity; Case series and Literature Review

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Abstract: Background: One of the effective methods used for treatment of obesity is the Laparoscopic Sleeve gastrectomy which is comparatively safe. Diagnosis of leakage is mainly based on clinical suspicion and lab radiological evidence. The Laparoscopic sleeve gastrectomy is superior in comparison to other restrictive procedures due to the decrease of large parts of ghrelin producing stomach mass. **Aim of work:** To estimate the incidence of early complications following laparoscopic sleeve gastrectomy and how to manage those complications. **Patients and Methods:** This study is a prospective case series which has been conducted at Ain Shams University Hospitals recruiting 300 patients who underwent laparoscopic sleeve gastrectomy upon between March 2017 and March 2018 with minimal follow up of one month postoperatively. Prospective data were reviewed from patient files. **Results:** Our study included 300 patients with mean age 37.1 ± 20 . The mean body mass index was 41.95 ± 4 while body mass index $< 40 \text{ kg/m}^2$ was 5% and BMI was $40 - 50 \text{ kg/m}^2$ was 95%. Medical co-morbidities were in the form of hypertension in 30% of cases, DM in 40% of cases and obstructive sleep apnea in 6% of cases. The operation time was 30-40 min and the average of hospital stay was 1.2 (1-4) days. The postoperative complications were staple line leakage in 0.6% of the cases, staple line he in 0.6% of cases, wound infection in 0.3% of cases, portal vein thrombosis in 0.3% of cases and chest infection in 0.6% of cases. **Conclusion:** Leakage and hemorrhage after LSG are diagnosed clinically and by radiological investigations. Mesenteric Venous Thrombosis is a subtle complication that warrants high index of suspicion for immediate management. Further studies are needed to detect the best treatment methods for early complications.

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Keywords: Laparoscopic Sleeve Gastrectomy, early complications, leakage, hemorrhage.

1. Introduction

The incidence of morbid obesity is growing, accompanied with increasing levels in many serious disorders such as diabetes, arthritis, cardiovascular illness and sudden death. It's expected to face a rising cost of health service in the coming decades as the obesity population getting older. Of course Dietary, Nutrition and pharmacological interventions get the best results on the short term, but usually fail. On the other hand Surgical interventions offers a safe and permanent Long term weight reduction result (1).

After considerable weight reduction cardiovascular disease, diabetes, arthritis and hypercholestrelemia have been shown to improve, and may to resolve completely Morbid obesity as well is distantly accompanied with elevation in the anxiety and depression levels, as far as increases the risk of metabolic and physiological abnormalities (2).

Dietary, Nutrition and pharmacological interventions fail to maintain long term weight loss in

obese patients; as a result surgical interventions are the best choice for them.

Whether the mechanism of access is open or laparoscopic. We can use different mechanisms to achieve weight loss like restriction, malabsorption, or both (3).

The laparoscopic sleeve gastrectomy (LSG) is an effective surgical technique to treat obesity as the ghrelin producing mass of the stomach is removed. Early LSG researches regarding the super-obese (Body mass index $> 60 \text{ KG/M}^2$) and the high-risk patients with many diseases that underwent a LSG as the first step operation in the bariatric surgery avoided complications and mortality and lost weight to facilitate the second operation within six months like gastric bypass (4).

However, Nowadays many surgeons doing LSG as it's easier and faster technically and showing great weight loss results compared to other restrictive or Malabsorptive techniques, with lower complication rate. (4).

Staple line leakage (1-2%), staple line bleeding (1%) and pulmonary embolism are considered major complications after laparoscopic gastric sleeve.

Other complications include too tight stomach or partially twisted. Rare complications including abdominal organs injury such as the spleen, pancreas or intestine (5).

0.2% cases have been reported as the Incidence of mortality after sleeve gastrectomy. Caused by pulmonary embolism, septicemia, pneumonia, heart attack, and stroke (6).

Aim of the work

This is a prospective study to estimate the incidence of early complications after LSG and to highlight our local strategies on how to manage those complications.

2. Patients and Methods

Study design:

This study is prospective case series that has been conducted at Ain Shams University Hospitals recruiting 300 patients who underwent laparoscopic sleeve gastrectomy between March 2017 and March 2018 with minimal follow up of one month postoperatively. Informed consent has been taken from all patients who accepted to participate in the study. Confidentiality is assured of the personal data and medical information of all patients.

Patients:

Inclusion criteria: Subjects having BMI > 40 kg/m². Patients with BMI between 35-40 kg/m² with other co-morbidities as hypertension, diabetes, obstructive sleep apnea.

Exclusion criteria: Patients with blood disorders and those who underwent previous abdominal surgery.

Methods:

All patients will be subjected to the following

Preoperative Routine preoperative investigations are requested for all patients, including complete blood picture, coagulation profile, liver and kidney function tests, fasting blood sugar and pelviabdominal U/S. Special investigations are requested for patients with specific co-morbidities as pulmonary function tests for patients with manifestations of chronic obstructive airway disease; ECG and echocardiography for patients above the age of 40.

Surgical technique

Step 1: Patient positioning and port placement: The patient sited in the supine location and then Trendelenburg position at the time of ports have been made. To retract the left lateral segment of the liver a 5mm subxiphoid Nathanson liver retractor is located. we put 4 openings, first 12mm superior and left to the umbilicus as camera port, second 12mm

port at right midclavicular line for stapling and surgeon right hand, third port at left midclavicular line for stapling and the last one is a port 5 mm in diameter at left anterior axillary line port for the assistant (Figure 1).



Fig. (1): Port placement in LSG.

Step 2: Gastric mobilization; By using a source of energy, perform an opening into the omental bursa around 2-4 cm proximal to the pylorus. Proceeding superiorly in close contact with stomach serosa, seal and divide the omental vessels (figure 2).

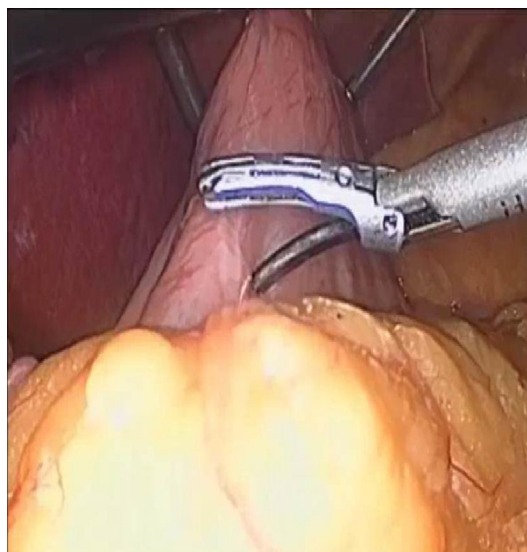


Fig. (2): Mobilization of greater curvature starting from 2-4 cm of pylorus.

Mobilization of the cardia. Just the antrum has been moved, it will be easy to pull in the stomach in the direction of the right of patient and hence inferiorly permitting best exposure of the stomach bed and exposure of pancreas then devascularization of the cardia by sealing and cutting short gastric vessels in close contact to stomach rather than the spleen to avoid injury of the spleen, we continue dissection of the greater curve up to expose the left crus of the diaphragm completely till the white line as our end point of dissection. The huge amounts of anterior fat pad is increased in volume and prevent the visualization of the distal esophagus and the medial cardia. Move this fat pad to able for visualize well this region for most favorable stapling and suturing. at the end of dissection the stomach should be completely free and freely mobilized to the patient right side by removing congenital adhesion between the stomach and pancreas till complete visualization of posterior lesser curve vessels (Figure 3).

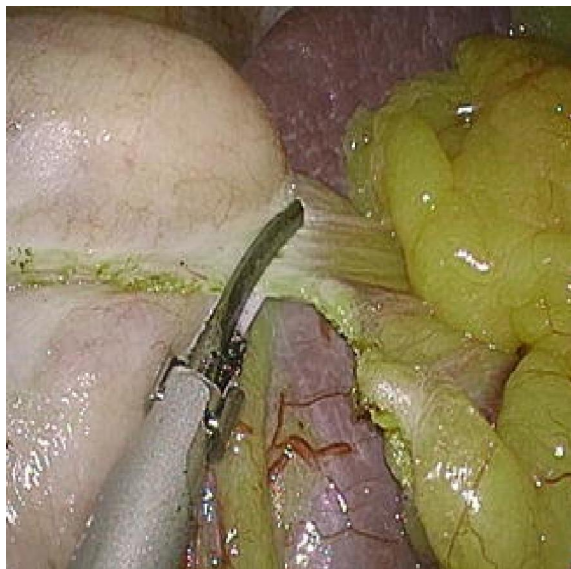


Fig. (3): Mobilization of the cardia.

Step 3: stapling A36 French orogastric bougie is placed adjacent to the pylorus A 60mm green cartridge is applied to staple 2- 4 cm proximal to the pylorus and introduced through the right midclavicular port, The second cartridge 60mm gold colure is in proximity to the incisura angularis is introduced from the camera port and care must be taken to avoid stenosis here. We then continue stapling of the stomach and The Staple should be equidistant from lesser curve by looking posterior and anterior to avoid twisting of the stomach, Retained fundus occurs if the stomach is not viewed from both anterior and posterior during placement of the stapler

The mainly difficult step is the positioning of the last two cartridges at the top of the stomach for accurate calibration or measurement. at the pad of fat we should stapling anteriorly outside it and then rotate anteriorly both the stomach and the stapler for careful examination and take back the posterior gastric wall via the cartridge before to obliterate it. Exposure of the left crus verifies the cardia has been well mobilized. - The last cartridge should be located 2cm from the gastroesophageal (GE) junction. An intraperitoneal drain was left for 24 hours in all patients.

Postoperative:

All patients were monitored to detect early symptoms subjective to complications such as tachycardia, tachypnea, hypotension and fever. All patients were discharged on the 1st postoperative day after removal of the drain. They started clear oral fluids for 2 weeks and then soft food for the 3rd and 4th weeks. Patients were followed up in the outpatient clinic on weeks 1, 2, 4, and 8.

3. Results

The mean age of our study population is 37.1 ± 20 with gender distribution as 225 for ladies, and 75 for gentlemen. The mean BMI was 41.95 ± 4 , with 285 patients (95%) having a BMI between 40-50, while only 15 patients (5%) exceeded BMI of 50. Hypertension was recognized in 30% of patients, DM in 40%, and OSA in only 6%. The time of operation was averaged 40 ± 10 minutes, and the hospital stay was averaged 1.2 days (ranging from 1-4 days).

Table (1): Patients' criteria and general data.

Number of patients	300
Age ¹ (yr)	37.1 ± 20
Sex (Female/male)	225 / 75
Body Mass Index ¹ (kg/m ²)	41.95 ± 4
Body Mass Index < 40 kg/m ²	15 (5%)
Body Mass Index 40-50 kg/m ²	285 (95%)
Comorbidity	
Hypertension	90 (30%)
Diabetes	120 (40%)
Obstructive sleep apnea (with CPAP)	18 (6%)
Operating time ¹ (min)	40 ± 10
Hospital stay ¹ (d)	1.2 (1-4)

¹Data are expressed as percentage of total, or Mean \pm SD, plus range in parentheses. BMI: Body mass index; HTA: Arterial hypertension; CPAP: Continuous positive airway pressure.

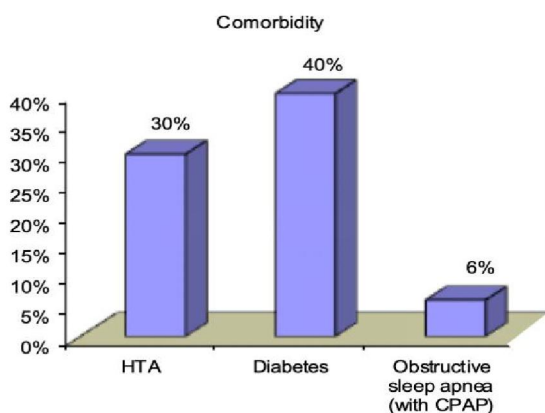


Fig. (4): Patients' percentage of co-morbidities.

Morbidity and mortality:

There was no mortality was recorded in the current series of operations. The most complicated symptoms 30 days post operation was 2.3%. The form and severity of side effects are tabulated in Table 2. Postoperative bleeding was detected in 2 patients

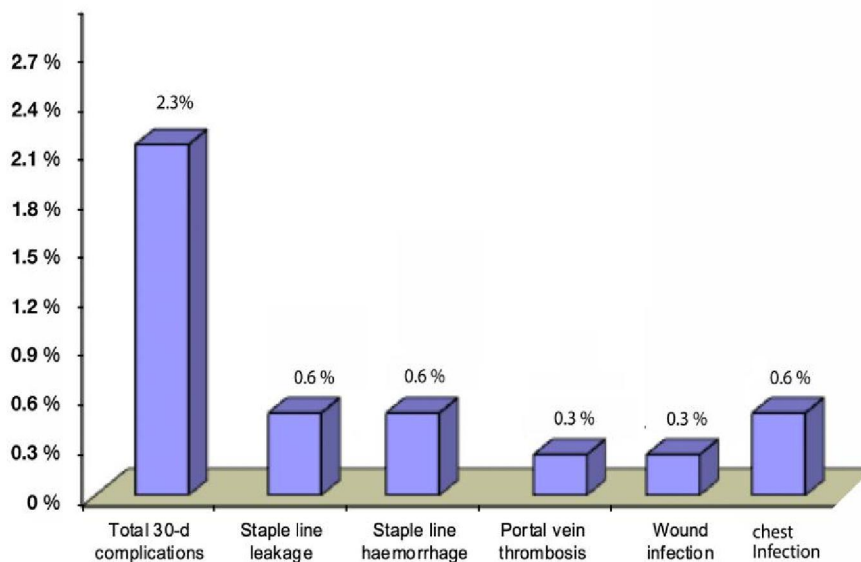


Fig. (5): Percentage of early complications after laparoscopic sleeve gastrectomy n (%).

An outflow or a leakage was detected at the staple-line in 2 patients (0.6%). An endoprosthesis or self-expanded wall-stent was needed in one patient 17 year old female in the 10th postoperative day, complained of fever, anorexia, and malaise. Then the fever became hectic with tachycardia. Pelviabdominal ultrasound revealed localized intraabdominal collection 4x4.5 cm. Multislice CT of the abdomen and pelvis revealed a localized collection distending the stomach wall and located between the stomach medially and posterior to the left lobe of liver measuring 6x4x4.5 cm with surrounding fat plane

(0.6%). One of them was diagnosed by tachycardia, hypotension and drop of hemoglobin level by 2gm/dl. It was managed conservatively by blood transfusion. The other patient was diagnosed by evident bleeding in the drain and tachycardia. It was managed by re-laparoscopy to control the bleeding point, after which postoperative ICU admission was needed for 2 days for monitoring. Non of the patients was suffering from pulmonary embolism or deep vein thrombosis at the time of admission.

Table (2): Mortality and early complication rates after laparoscopic sleeve gastrectomy n (%).

Mortality	No. (%)
Total 30-d complications	7 (2.3%)
Staple line leakage	2 (0.6%)
Staple line haemorrhage	2 (0.6%)
Portal vein thrombosis	1 (0.3%)
Wound infection	1 (0.3%)
Chest infection	2 (0.6%)

haziness (figure 6). Percutaneous drainage of the collection was done via pigtail. Upper GI endoscopy was done which revealed defect at site of gastroesophageal junction with introduction of "Megastent" (Figure 7). On the fourth day, the patient was discharged after stent situation, with a liquid diet, antiemetic drugs, a proton pump inhibitor agent, and directions to sleep in a semi-sitting situation. At the day 7, good flow through the stent was observes as an indication for a good position as shown by a radiography of medium contrast. Within the weeks of follow-up, diet was changed from liquid to soft foods,

and the patient not complain from painful condition, with irregular biliary vomiting. 4 weeks post operation, the patient was prepared for removal of stent. The stent was removed without difficulty. Endoscopic revision confirmed by a radiography of medium contrast showed closing of the leakage site. Along a 3-month of follow-up visit, the patient was free from any symptoms.

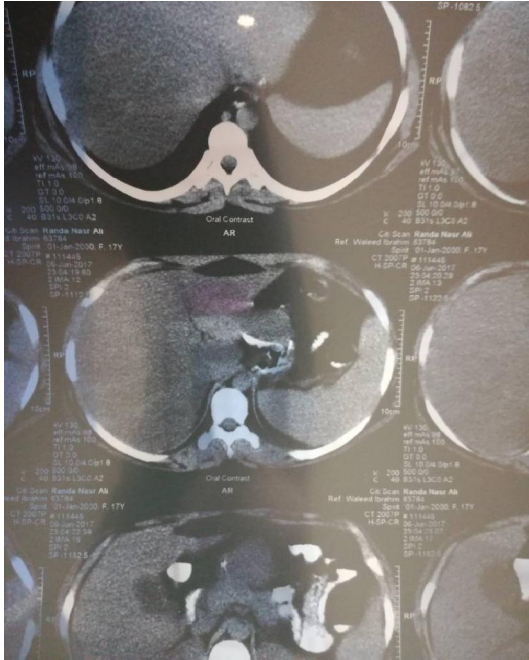
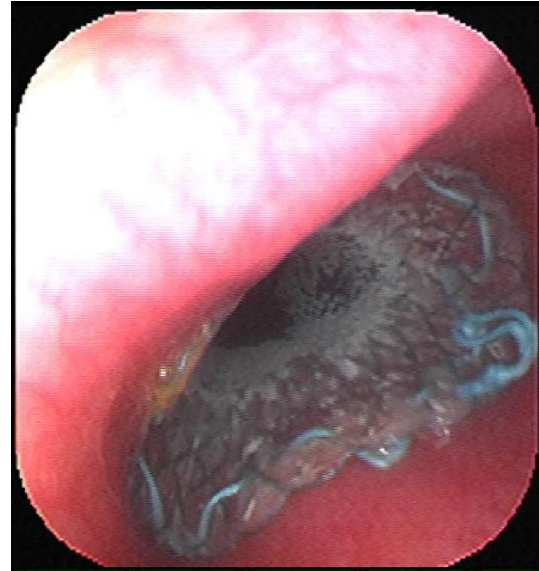


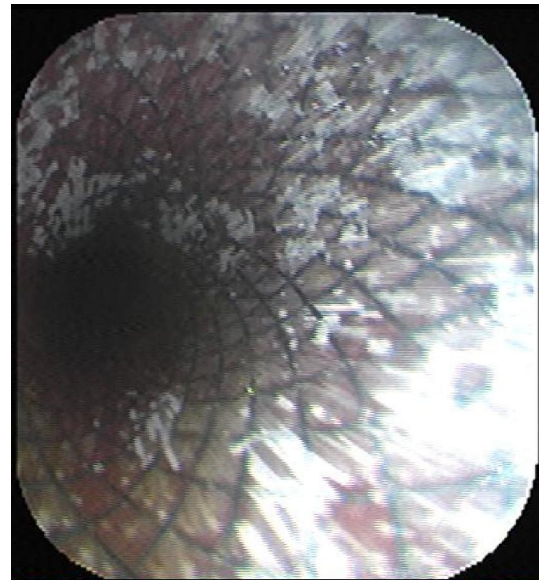
Fig. (2): Multislice CT of the abdomen and pelvis revealed a localized collection.



(A)



(B)



(C)

Fig. (7): Megastent as treatment of post LSG leakage. (A). stent inserted before expansion. (B). stent being expanded. (C). Stent after expansion.

The other patient presented after 3 weeks by hectic fever and vomiting so 3D virtual gastroscopy was done that revealed contained leakage (figure 8A) so internal drainage by double J drain was done by endoscopist with complete drainage of the contained abscess cavity (figure 8B). After that, the patient was followed up for two months as an outpatient, then endoscopist removed double J with complete healing of the leakage.



Figure (8) 3D virtual gastroscopy. (A) contained leakage. (B) internal drainage by double J pigtail.

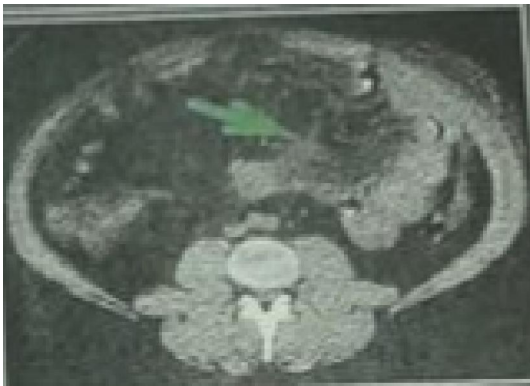


Figure (9) multislice CT scan revealed bowel thickening with mural edema and evident mesenteric congestion



Figure (10) laparoscopic exploration with evident gangrenous jejunal loops.

In our study one patient suffered from mesenteric vein thrombosis (MVT) (0.3%) on 15th day operative. The patient complained of acute severe abdominal pain, nausea, vomiting and low grade fever. However, leukocytosis was obvious. C.T scan was done and revealed a segment of bowel thickening with mural edema and evident mesenteric congestion affecting the jejunal loops at the left iliac fossa

(Figure 9). Laparoscopic exploration was done revealed gangrenous proximal jejunum (Figure 10). Abdominal exploration was done with resection of about one meter of proximal jejunum 30 cm distal to duodenojejunal junction (Figure 11). Then, jejunostomy and mucous fistula were done. 2 months later, we did restoration of bowel continuity.



(A)



(B)

Figure (11) Abdominal exploration (A) gangrenous jejunal loop after 30cm. from duodenojejunal junction (B) resection about one meter of the jejunal

4. Discussion

Although LSG is a simple bariatric operation with low rate complications it can be very difficult procedure even for advanced skills laparoscopic surgeons (7).

To prevent the stapler line leak and fistula, nowadays, there is no agreement on the most efficient parameters, while Shikora SA and Mahoney succeeded in reducing significantly the rate of leakage and bleeding during laparoscopic sleeve gastrectomy through reinforcing of the staple line (with sutures or buttressing material) (8).

Much debate has recently been raised about the methods for doing stapler line reinforcement. Many researchers reported no variations amide over sewing of the staple line and the buttresses use. However, by reviewing 8920 patients systematically, it was recorded that in LSG, the leakage rate is minimal (1.1%) after using absorbable membrane (Seamguard®) in the suture, while it was slightly higher when using oversewing (2.0%), no reinforcement (2.6%), bovine pericardial strip (BPS-Peristrips®) reinforcement (3.3%) and using both sutures and buttressing material (3.6) (9). In our study we didn't use any reinforcement and the leakage rate was 0.6% .

However, an increased risk of bleeding and tearing and at the site of penetration of suture when using over sewing method as some authors reported (10).

As regard bleeding of the suture line Shikora showed that similar findings regarding the high frequency of bleeding were seen in absence of non-reinforcement of the staple lines and the decreased frequency was documented for the staple lines

buttressed with bovine pericardium. While, intermediate rates of bleeding was obtained after using of a glycolide copolymer or suture oversewing (8).

There is widespread debate about the actual real etiology of stapler line leakage which usually located at the proximal 4 cm or less of the sleeve. Contributing factors include tissue ischemia, high pressure system, poor healing, and suboptimal closure procedures comprising staple malformation, inappropriate stapler height option, or formation of hematoma. Holding of blood supply for long time considered as a key element in determining an integrity of staple line and anastomoses. Perez demonstrates that the arterial blood supply to the proximal sleeve is weak, the site of nearly all leaks. Specifically, the disruption of the posterior attachments of the proximal sleeve may be predictable to interrupt blood supply, particularly branches of the left gastric artery. It is apparent that over dissection of the left crus of the diaphragm devascularise the proximal sleeve with ischemia that lead to increase the rate of leakage (11).

According to the clinical condition of the patient, the control of leak are planned. The surgeon managing the leak as one of the complications of the operation must have a obvious treatment protocol or algorithm depending on period of the leak, the patient's condition, and the available resources.

Well localized leak with no generalized peritonitis with stable general condition of the patient that represented lately can be managed by ultrasound guided pig tail drainage to relieve the toxemia followed by endoluminal management to promote closure of leak like endoluminal stenting, endoscopic clips or fibrin glue. (12).

The results of using stents is variable depending on the diameter and duration of leak and can be applied only in small series of special individuals. Even though position of self-expanding, covered, or partially covered stents (Polyflex or WallFlex stents, Boston Scientific, Natick, MA) may be valuable, the existing stent technology is not perfect for this anatomy. The complexity represented in the diameter of lumen, where the curvature of the gastric lumen having two different lumen diameters (12).

One of the main complications post operation is the migration of stent following the procedure and it is incidence reached 20%–59% of cases between dissimilar series (13).

The outline of the proximal part and the angle of the stent, regarding the stent body permitted entire recovery of the leak, consequently enhancing the healing process. Before placement of stenting, many procedures must be taken and considered very urgent to promote closure of the leak in all cases, adequate

evacuation of the extra luminal collection and surgical situation of drains with washout of the infected area. In carefully selected patients, a high percentage of success was achieved after stenting, but this success not sufficient to construct any broad claims that stenting promotes or accelerates closure of leaks generally for all individuals. On the other hand, stenting may be a valuable therapeutic addition in some patients and is accompanied with satisfactory rate of risk.

For controlling of hemorrhage, blood transfusion for patient is necessary to stabilize hemoglobin level, exacting nutrition, fluid resuscitation, and output monitoring with Foley catheter (14). In haemodynamically stable subjects can be taken conservative treatment only with follow up of vital data, monitoring hemoglobin serially and withdrawn the drain continuously. Most of acute postoperative bleeds cases continue with conservative management, but in clinical doubtful cases of bleeding, performing CT angiogram for revealing hematomas and possibly identify the bleeding vessel. in case of detection of the site of bleeding, angioembolization can be carried out to manage bleeding (15).

In the case of intraluminal bleeding and patient is unbalanced to go on to radiology suite, then the patient will require necessary endoscopic intervention—oesophagogastroduodenoscopy (OGD). Early endoscopic intercession must be done only by a skillful bariatric endoscopist. Through the endoscopic examination, you can evaluate the bleeding condition, and in the same time permitting for injecting of vasoconstrictor drug such as adrenaline at the site of bleeding or insertion of clips to stop bleeding. Endoscopic interference must be tried in the operating room in the event patient not satisfied and seems unstable, and bleeding cannot be controlled endoscopically therefore that necessary and urgent interference surgically are required (15).

Instability of hemodynamic during intra-abdominal bleeding required urgent surgical interference. To identify the bleeding source, primary diagnostic laparoscopy is a good option to allow direct visualization of the site of bleeding. laparoscopy also permits suction or aspiration of the hematoma and a thorough washing of the place of hematoma to prevent the infection and formation of an abscess. In some cases when no obvious source of bleeding is recognized it may be desirable to over sew the whole staple line.

Many methods are used for controlling intraoperatively hemorrhage, one of the communal technique is through intraoperative packing via inserting a gauze for assisting and to know the source of bleeding to assist for stopping bleeding and starting the processes of hemostasis. The second method used

for reduction of bleeding is through increasing abdominal pressure. Aspiration and infusion of fluids can help to recognize an origin of hemorrhage, and permit for the using of a clip (15). In addition, 60 seconds of pressure time has significantly decreased staple line bleeding instead of 20 seconds after closure of the stapler before firing (15).

It is very urgent to inspect the whole staple line after withdrawal of the bougie. For reducing the frequency of bleeding it is necessary to detect bleeding in the operating area post-operatively in case of minor bleeding and can be controlled easily by small clips. Sometimes, the bleeding may be arisen from the resected area of the omentum post-operation and by using drains may assist in the identification of this type of intra-abdominal bleeding (16).

During laparoscopic general surgery, portal vein thrombosis can be occurred, it is a well-known, uncommon side effect of operations that include the mesenteric or portal veins and may be possibly threatened the life because of mesenteric infarction or ischemia (17). Clinical symptoms may be delicate and needs a high index of doubt. In one patient of our series, larger than expected drainage fluid in the postoperative period has represented early ascites and MVT. Most generally, patients existent nearly 2 week post-surgery with nausea, generalized abdominal vomiting, pain, and fever of low-grade (18). The chemical analysis and laboratory diagnosis of some parameters are within the normal values; though, mild elevation of liver function tests and leukocytosis can also be observed. Therefore, the result of physical examination may be seemed to be normal, or otherwise, if concomitant with abdominal ischemia, patients could complain from peritonitis and septic shock, which required quick interference and the patient backed to the hospital with a typical clinical symptoms of MVT. On the other hand, this performance is nonspecific, particularly as nausea, unclear abdominal pain, and vomiting which can also be observed in the normal postoperative course of sleeve gastrectomy for a few weeks. Moreover, the patients in the present study complaining from ascites, which was detected by CT. About 1/3 of patients who present with MVT are suffering from ascites, and may be linked with postponed start of anticoagulation therapy or thrombus resistant to recanalization (19).

The accurate diagnosis of MVT can be performed by noninvasive imagining such as with color Doppler ultrasonography or with contrast-enhanced CT and also can be diagnosed by more invasive method via portal venography which is naturally not essential (20).

Treatment of MVT is depending on many parameters such as the acuity of the disorder and the original etiology, if diagnosed. Administration of

anticoagulants is suggested in stable, non-cirrhotic subjects with acute MVT. The proposed interval of treatment is 6 to 12 months. In case of patients with identified systemic prothrombotic states, treatment may be continue along the whole life, with the objective of recanalization of the portal vein (21).

Conclusion

Leakage and hemorrhage after laparoscopic sleeve gastrectomy can be diagnosed clinically rather than laboratory and radiological investigations, which should not delay the decision of immediate surgical intervention if necessary. Mesenteric Venous Thrombosis could be a silent life-threatening complication, therefore, a high index of suspicion is mandatory for early diagnosis, and for commencing immediate and prompt treatment. Further studies are required to establish a consensus on the best treatment modalities for each individual complication.

Conflict of Interest: None to declare

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